



SunPCi™ Supporting Highly Available PC Applications with Solaris™

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Sun PCi™ Supporting Highly Available PC Applications with Solaris™

In the last installment of these articles, we looked at tips and techniques you might find useful when migrating to a Solaris™ PC NetLink system. In this installment, we will focus on creating a highly available environment for supporting PC applications, using the newly introduced SunPCi card. While we will focus on high available PC applications, we will also look at how the SunPCi product can solve both hardware and software compatibility and functionality problems between PCs and the Solaris Operating Environment. While the current SunPCi card is not designed to offer a scalable solution for a community of users (it supports one user at a time), its versatility makes it a tool that can provide many solutions for problems that PC server consolidations can generate.

The quest to reduce the number of systems in data centers, while increasing reliability and availability, has led customers to consolidating to more scalable and reliable servers. As the customer's transition from Windows NT based PCs to more scalable Solaris (SPARC™ Platform Edition) systems proceeds, support is often needed for PC-related devices and software. Sometimes, a single nagging hardware compatibility issue can force the data center manager to keep an older server around, consuming valuable real estate and system management cycles. Alternately a wintel based application or conversion tool might be needed to support some part of the consolidation process itself. In contrast, the Solaris PC NetLink product offers full compatibility in the areas of network services, but it doesn't support devices that require 100 percent Wintel drivers and I/O ports found only on PCs.

The SunPCi card offers an excellent cost and space savings alternative to PCs when users are primarily using SPARC PCI-based workstations. The default configuration of the SunPCi software is a conservative configuration. It is not optimized to give the best performance, nor is it friendly to nightly backup procedures. Later in this article (See "Recommendations for Using Drives Within SunPCi" below) a optimized configuration is offered.

What is the SunPCi Card?

The SunPCi card offers a complete PC hardware environment on your PCI-based SPARC system running the Solaris Operating Environment. It is a real PC on a PC card. All chip level functionality available on a PC motherboard exists on the SunPCi card. With the card, you can install and run either the Windows 95 or Windows NT 4.0 Workstation operating systems, and any of the thousands of productivity applications on your workstation, along side your Solaris applications. In addition, the 100 percent compatible parallel, serial, and USB ports make Solaris systems compatible with thousands of low-cost devices that use these ports on PCs. For a full description of the SunPCi card see

<http://www.sun.com/desktop/products/sunpci/>.

Because the SunPCi card uses the Solaris Operating Environment for much of its standard I/O, it can actually support PC applications more reliably. Its ability to support hardware interfaces at a 100 percent level of compatibility extends the functionality of applications that run on the card.

The SunPCi card supports Wintel applications using retail versions of Microsoft Windows 95 and Windows NT operating systems. While nothing can improve the stability and reliability of these operating systems beyond their current state, the SunPCi card has several features that allow you to recover from OS/application problems much faster than on real PCs.

SunPCi Hardware Background

Sun has been shipping co-processor, X86 based products for years in the form of SBus and VME cards for older Sun™ systems. In contrast to the previous products, the SunPCi card is a not only a PCI card, as the name implies, but it has added hardware that makes the card 100 percent compatible with the PC's serial, parallel, and USB ports, as well as sound interconnections, a 300Mhz AMD K6-2 processor, and up to 256 megabytes of private memory. These features make the card capable of supporting virtually every Wintel application and almost every low cost device available in the PC market.

SunPCi Hardware Solutions

- **The parallel port** has been used by hardware vendors for everything from ZIP drives to scanners, in addition to the printers the port was originally designed to support. While many SPARC systems have parallel ports, a lack of application and driver support has made it difficult to take advantage of these devices. Because the parallel port is designed into the PCI card itself, the software running on the SunPCi product recognizes a real PC compatible port with no emulation layers that can cause problems. To verify this compatibility, I attached a parallel

port ZIP drive to a SunPCi card. The installation program worked perfectly, and I was quickly copying files to and from the ZIP drive media. Other devices and software drivers designed to work with the PC parallel port will work fine as well. This includes scanners, backup tape devices, LapLink compatible cables and software, digital cameras, and other bidirectional devices. To use the parallel port, make sure the SunPCi BIOS setup uses ECP/EPP for the parallel port.

- **The serial port** - The SunPCi product has a built-in, 100 percent compatible 16550 PC serial port. The serial port is used primarily to support an external modem. While several Solaris technology-based solutions support modems for data and fax applications, the cost of converting may be too great. If the PC you are replacing already has a working modem, there is no need to convert. Simply move the program and modem to the serial port of the SunPCi card. Some external desktop modems support voice phone access, which allows for a variety of phone solutions that data centers may require.
- **The USB port** - The Universal Serial Port standard is at critical mass in hardware and software support. There are USB versions of printers, ZIP drives, video cameras, RW CD-ROM drives, and almost every common PC device. At this writing, the SunPCi USB port is the only USB port Sun officially supports. This is clearly the best way to expand the capabilities of the SunPCi card.
- **The VGA port** - The SunPCi software will create a Windows 95 or Windows NT window within the Solaris CDE display. This saves the real estate needed for a separate PC Monitor. However, if you want a separate display, the SunPCi card supports an external VGA connector. You must connect the mouse and keyboard to the SunPCi session using the SunPCi GUI to use these devices with a SunPCi session.
- **SoundBlaster compatible Sound** - The SunPCi card supports Line In/Out and Mike In audio. Video phone and network conferencing software require the use of sound in and out capability. You must either hook up external speakers to the card or use an audio cable to connect the line out of the SunPCi card to the line in of the SPARC system. To hook up the CD-ROM audio output, use an external audio cable from the CD-ROM to the audio input of the card.

While low cost PC devices on these ports will typically not meet any stringent performance demands of data centers, they can offer a variety of options that may be required to allow compatibility with media that the end user community may demand on a casual or infrequent basis.

SunPCi Software Solutions

The SunPCi card is fully integrated into the Solaris Operating Environment and offers many useful features. Most of the features are supported by the drivers that interface at the boundary between the Wintel and Solaris environments. Following is a list of some of the interesting possibilities based on this architecture:

- **The SunPCi screen is X-11 based** - The SunPCi card supplies both a Windows 95 and Windows NT 4.0 workstation graphics driver that displays inside a X-11 based window in the Solaris CDE environment. This window supports text-based cut and paste between the Solaris and SunPCi environments. The X-11 display can be as big as the screen. If your client-side X server supports 1600x1280, so will the SunPCi software. The driver also supports 8-bit and 24-bit modes. When the SunPCi driver initializes, it queries the X environment and adjusts the maximum values in the Display Properties window.

You can view the screen to monitor processes and devices from anywhere on the network. The SunPCi card can be used as a mini application server where users can access a one-license application that is installed into the SunPCi environment. Because only one user can use a SunPCi card at a time, installing the software into a SunPCi environment and allowing users to use the card over the network self-regulates the use of the software.

- **Network Driver Interface Specification (NDIS) driver** - The SunPCi card supplies a protected mode NDIS driver for both the Windows 95 and Windows NT 4.0 workstation operating systems. This driver allows Sun PCi technology-based systems to support not only NetBIOS over TCP/IP (the same protocol used by Solaris PC NetLink software to support network service), but also NetBEUI, and Novel Network IPX/SPX-compatible protocols. This allows access to the majority of PC networks that exist. You can share any of the drives defined in the SunPCi environment with any other PC running on the network. Note that this solution is limited in performance and scalability and should be used for low volume situation or as a quick work around. Use Solaris PC NetLink for sharing Solaris based file structures at a high capacity server level.

Both PC NetLink and SunPCi can coexist on the same system without problems in the network layers because a separate stream is setup that allows a separate IP address for the SunPCi card. The two NetBIOS layers in each environment coexist in the same system because the separate IP address exists for the SunPCi NDIS driver.

- **DOS redirector (DOS only)** - These drives are supported by redirector code that is loaded by DOS during boot by `config.sys`. They are available only during DOS Real Mode sessions. The `AUTOEXEC.BAT` file initially maps the H: drive to your home directory, the R: drive is mapped to the root Solaris file system, and the F: drive is mapped to a SunPCi executable directory. These drives are defined by the DOS `c:\sunpc\sunpcnet use` command.

After Windows 95 is installed, the H: and R: drive mappings are removed from the `autoexec.bat` file. The user is encouraged to define replacements for these drives using the Windows 95 file driver, which can better support the mapping with long file names and windows specific functionality. The DOS redirector can support only short (8.3), upper case file names. Files and directories with long file names are displayed with the tilde (~) character to signify that the name was too long.

- **Drives supported by the Windows 95 file driver (Windows 95 support only for Versions 1 and 1.1)** - While the NDIS network driver and the Windows 95/NT operating system combination can map PC based network drives to the SunPCi environment, drives defined by the SunPCi environment supplied Windows 95 file system driver allow you to map file structures in the Solaris environment to the SunPCi software.

Like the DOS redirector, this software component allows you to map Solaris UFS file structures as well as Solaris-supported CD-ROMs and NFS network file structures to the SunPCi environment. This allows SunPCi access to the Solaris file system without the SMB server support code such as Solaris PC NetLink, Syntax Totalnet, or Samba software.

Drives defined by this mechanism are supported by a protected-mode environment and have full support for long file names and other Windows 95 calls.

- **Emulated Drives** - In addition to the extended drives and the drive maps that the native Windows networking supports, the SunPCi environment supports emulated hard drives. These drives appear to X86 software as real BIOS level hard drives and allow 100 percent compatibility when raw access to the disk is required. This allows Windows 95 to support FAT32 style file structures, and it allows Windows NT 4.0 to support NTFS file structures. Many virus protection scanners require this capability of accessing drives to the track sector level.

These emulated drives (usually drive C: and D:) are actually supported by SunPCi software using files located within the Solaris Operating Environment. By default your first C: emulated drive will be located in the `/pc` directory of your home directory. To avoid performance problems caused by accessing the C: drive over the network, it is suggested to move this file to a file structure located on the system where the SunPCi card is located.

Supporting a complete PC style C: drive via one Solaris file enables some interesting features not available on PCs. Here is a list:

- An emulated hard drive file can be saved or cloned by making a copy of the file. As you build up your Windows NT 4.0 workstation or Windows 95 environment you can keep a master copy to restore it quickly. If a real PC loses a C: drive, it can literally take hours to get it back to the same state, even if you do have a backup. It takes less than 30 seconds to redirect the SunPCi environment to backup the C: drive and restart the environment. Compressing the backup copy of the file while you copy it can save space. a command like `"cat C.diskimage|compress >>C.diskimage.Z"` allows you to copy and compress in one step.

Caution – Make copies of the emulated drive files *only* when the SunPCi environment is NOT running. Backing up the file while the SunPCi environment is running can result in a corrupted backup file.

- Supporting multiple operating systems, or multiple version of the same operating system is extremely easy. You simply have a different file for each OS environment. Being able to switch back and forth from one operating system to another quickly is a tremendous time saver. Make sure you have licenses for each operating system you use with SunPCi software.
- Because the drive is a file, you can clone and distribute whole C: operating system and application hard drive environments quickly.

Caution – Only one SunPCi card can access the same emulated drive file at a time. The first SunPCi environment that uses the emulated drive file will lock it, making it impossible for two cards to use the same file at the same time.

SunPCi Availability

Now let's look at the features presented above and apply them to the subject of availability.

SunPCi software cannot magically improve the stability and reliability of Windows 95 or Windows NT. It can decrease the number of unstable situations that can occur in these operating systems, and it offers a multitude of availability options.

Following is a list of extended availability options that the SunPCi card offers Wintel users:

- **The Solaris Operating Environment is the heart of the most critical device support** - Many Windows 95 and Windows NT stability problems are caused by lower level drivers interacting with the hundreds of motherboard chips, PCI, and AT cards on the market. The SunPCi card helps minimize these interactions by offering one well-tested, Sun-supported hardware environment. For the most important devices (namely the display, keyboard, mouse, hard drive, and network interface) Sun drivers interface to the Solaris Operating Environment. This virtually eliminates combinations of drivers and hardware that are *not* tested together.
- **Fast reboot** - Windows 95 and Windows NT machines are known to be less stable than Solaris environments. If a Windows OS problem does occur, the SunPCi environment can reboot very quickly allowing you to get back to work quickly. This is especially true if you configure the SunPCi environment using the setup recommendations offered near the end of the article.
- **Fast recovery** - Boot drives on Windows machines are notorious for becoming corrupted by application installations or system crashes. Because the boot drive is actually a UNIX® file, making a backup copy of the C: drive is as simple as performing a UNIX `cp C.diskimage C.diskimage.backup` command. If the C: drive within the SunPCi environment becomes corrupted, you can redirect the

SunPCi environment to a backup copy using the GUI, and reboot. No other PC environment can switch C: drives this quickly to get your application back up and running.

- **Capable of supporting Wintel applications over the internet** - The SunPCi environment works through the X-11 environment. Users with X-11 clients can access SunPCi Wintel-supported applications anywhere on the network. The applications run on the SunPCi card in the workstation or server and display anywhere there is an environment that supports X-11. Almost all UNIX environments ship with this support, and good X-11 software is available for PCs. Sun offers the Solstice™ Network Client product for this functionality. (<http://www.sun.com/software/solstice/netclient/ds-netclient/>) Because applications can be run over the internet, the SunPCi card can be installed inside a system that is in full control of the data center.
- **Moving Wintel environments** - If users need to move from one SunPCi card to another, they need only copy their emulated C: drive file to a place where the new SunPCi card can access it. After typing in the new location to the SunPCi GUI, their complete C: Wintel environment runs exactly as it did.
- **Identical application environments can be deployed quickly** - Multiple users needing to execute the same application environment can be given a copy of a C: emulation file. Moving a file from place to place is easier to support than reloading hard drives with operating systems and applications.

SunPCi Tips

Using the Map Network Drive in Windows 95

The Microsoft GUI window that define the network drives (supported by the NDIS driver) is the same window used to define extended drives (supported by the Windows 95 file system driver). It can be confusing which mechanism will be used to define the drive. The syntax for defining a Windows protected-mode file system driver is `\\dir\dir`. There are always two components. If you want to define a drive to access `/files1`, use the syntax `\\files1\` to force the Windows 95 file system to allow the definition.

If the Windows 95 file system driver does not see a valid path, the network environment uses the syntax to define a network drive. If the network path doesn't work, you'll get an error message.

While trying to mount an exported drive with Windows 95 on a SunPCi card using the Map Network Drive pop-up window, I received a "Device not connected" error. I was using the syntax `\\system\path` to attempt the map. This syntax will be first used by the Windows 95 file system driver failed. To succeed at mounting the remote PC's file system I gave a dummy third item (`\\system\path\.`). Because

three items are not allowed as a valid syntax for the Windows 95 file system driver, it was immediately given to the network environment which successfully defined the drive.

To force a map to Solaris root (/) file system use the syntax “\\.\.” .

Emulated Drives File Allocation

Emulated drives are supported by Solaris files. When you create a new SunPCi emulated drive using the SunPCi GUI, the initial space required to store the emulated drive file is typically about 4 megabytes. This disk has a bootable version of DRDOS and a directory filled with drivers that you may or may not need. The full space needed to store the emulated drive file is not allocated from the Solaris file system until the data is actually written by the Windows 95 or Windows NT 4.0 environments. The file size continues to grow until it reaches the full size originally specified in the SunPCi window or until the Solaris file structure is out of space. Running out of space causes errors you want to avoid. Once the file has reached a particular size it maintains a high water mark and will never get smaller.

To avoid Solaris running out of space trying to support the emulation drive file, first use the SunPCi /options/create a New Hard Drive menu selection to define a drive the size you need. Next use Windows 95 Scandisk or Windows NT 4.0 to do a “Thorough” check of the file structure. The act of the operating system reading the complete drive forces Solaris to allocate the full space specified for the emulated drive file.

Emulated Hard Drive Performance

Emulated drives usually perform well. There are two primary reasons for this. The first reason is that the SunPCi software opens only one Solaris file to access the data. Opening and closing files can be a time consuming process, especially if the files are being supported over the network.

The second reason the drives perform well is because the Solaris Operating Environment uses all unused memory as read cache for any open files it is supporting. After SunPCi software first stimulates Solaris Operating Environment to read portions of the emulated drive file, subsequent read operations are read from Solaris read cache memory.

To obtain maximum performance, place the emulated drives on the Solaris system where the SunPCi card is installed. By default, SunPCi software creates emulated drives in the users ~/pc directory, which, at most customer locations, is on a home directory server. Move the emulated drive file to a local file structure, and configure SunPCi to use the new file location. Moving the file out of the users home directory also has the benefit of avoiding backing up hundreds of megabytes nightly. This topic is discussed below.

Emulation Hard Drive and Backups

There is a down side to using emulated drives. Any use of the emulated drive, and thus the Solaris file, causes the last modified date and time to change. If your server room does nightly backups of file structures where emulated drive files reside, the complete emulated drive file will be backed up. This means a large emulated hard drive, requiring a 200-megabyte file, would require 200 megabytes of tape even for an incremental backup. This may be acceptable for small emulated drives (4 to 5 megabytes), but if you install Windows 95 or Windows NT, and several applications, the size of the file can easily be over 100 megabytes. Clearly something needs to be done to avoid backing up these files, especially if several users use SunPCi cards.

Recommendations for Using Drives Within SunPCi

Here is a recommendation for using SunPCi software that gives you maximum performance, minimizes the use of the network, and allows the Backup administrator to avoid backing up many hundreds of megabytes nightly.

1. Create a large, 200-300 Mbyte emulated drive locally on your own system using the SunPCi environment as your C: drive. Use Windows tools to scandisk the emulated drive and force it to allocate the space within the Solaris UFS file system. This forces the full allocation of the space needed to contain the drive and avoid problems with Solaris Operating Environment running out of space on the file structure later.
2. Install Windows 95 or Windows NT 4.0 into the drive, along with all your commonly used applications.
3. Backup the emulated file drive. This allows you to restore your SunPCi environment quickly if it becomes corrupted. Every time you install a new application, replace your backup file only after you are sure your installation did not corrupt the environment. If you have the space, keep a copy of the current backup and the previous backup so you can undo the previous install quickly.
4. Mount the H: drive using a SunPCi redirected drive to your Solaris home directory. Always place your personal documents and data files in your home (H:) directory so they get backed nightly during any incremental or full backup. When these files get touched by applications from the SunPCi environment, they will have updated dates and times that will allow backup software to correctly identify them for incremental backup procedures.

Because the C: drive that contains your SunPCi OS and applications is local to the system containing your SunPCi card, the performance will be maximized. Because you will save only user created documents and data files in the home directory, you will have minimized what needs to be copied during incremental backups.

Summary

The SunPCi card not only offers the most integrated Solaris and PC environment available, but offers a variety of improved availability options that can reduce the down time of running Wintel-based applications to a minimum.

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Don DeVitt started his career as an electrical engineer and has worked in the Automated Test industry (Teradyne Inc.), and PC operating system market (Digital Research from CP/M fame) before coming to Sun.